

Course Title	Clinical Pathology			
Course Code	Vet-403			
Course Type	Required			
Level	Undergraduate			
Year / Semester	Year 3/ Semester 1 (Fall)			
Teacher's Name	Course Lead: Contributor:			
ECTS	6	Lectures / week	3	Practicals and Tutorials / week 2
Course Purpose and Objectives	<p>The main objectives of the course are:</p> <ul style="list-style-type: none"> • To teach the student the physiological parameters of the body and the composition of biological fluids, the influence of various factors on the occurrence and nature of the pathological process • To teach the students the etiology of diseases, the pathogenesis of typical pathological processes and the features of their manifestation in various animal species • To teach the students to appropriately select and interpret laboratory tests • To teach the students to utilize in-house lab or specialty reference lab to efficiently make accurate diagnosis without running unnecessary and low-yield tests. 			
Learning Outcomes	<p>The following list provides the learning objectives that will be covered in the lectures, lab practical sessions and tutorials of each week:</p> <p>Week 1</p> <p>LOBs covered during lectures:</p> <ol style="list-style-type: none"> 1. Explain the common units and abbreviations for laboratory values 2. Describe the blood sample, urine samples and other body fluids samples collection. 3. Explain the difference between serum and plasma 4. Discuss the differentiation of pluripotential stem cells to the cell lines of the hematopoetic system 			

5. Name the different white blood cells and their functions
6. Describe the CBC and its major components
7. Explain what a left shift is
8. Name diseases and conditions that cause neutrophilia
9. Name diseases and conditions that cause neutropenia
10. Describe conditions of abnormal lymphocyte concentrations
11. Describe conditions of abnormal monocyte concentrations
12. Describe conditions of abnormal eosinophil concentrations
13. Describe conditions of abnormal lymphocyte concentrations
14. Describe conditions of abnormal basophil concentrations
15. Describe conditions of abnormal mast cell concentrations

Week 2

LOBs covered during lectures:

16. Describe the erythropoiesis
17. Describe the erythrocyte structure, function and degradation
18. Compare the blood erythrocyte concentrations in various animals
19. Describe the hemoglobin structure, function, synthesis and degradation
20. Explain what the reticulocytes are and conditions in which they are increased
21. Describe the erythrogram
22. Describe causes for abnormal erythrocyte volume
23. Describe causes for abnormal erythrocyte shape
24. Describe causes for abnormal erythrocyte color
25. Describe what is anemia and the classifications of anemias
26. Causes of anemias classified by erythrocyte indices (MCV and MCHC or CHCM)
27. Name disorders and conditions that cause nonregenerative anemias
28. Name disorders and conditions that cause regenerative anemias
29. Describe erythrocytosis and polycythemia and the causes there of

Week 3

LOBs covered during lectures:

30. Describe the platelets their synthesis and their function
31. Discuss methods for determining platelet concentrations
32. Discuss thrombocytopenia and diseases and conditions that cause it

33. Discuss thrombocytosis and diseases and conditions that cause it
34. Discuss what hemostasis is and the different mechanisms
35. Name diseases and conditions that cause thrombocytopathies
36. Discuss possible causes of abnormal results for the major tests of hemostasis
37. Describe the bone marrow, its composition and functions
38. Name indications for bone marrow examinations and the methods
39. Name conditions that cause erythroid, granulocytic or megakaryocytic hyperplasia in marrow
40. Name conditions that cause hypoplastic states in marrow
41. Describe classification of hemic cell neoplasia involving blood or marrow
42. Describe the lymph nodes, major concepts and terms
43. Describe the lymph node classifications

Week 4

LOBs covered during lectures:

44. Give a short summary of the general concepts for total protein, albumin and globulins
45. Describe the analytical principles for total protein, albumin and globulins
46. Describe protein disorders and the causes
47. Explain hyperalbuminemia and hypoalbuminemia and the causes
48. Describe acute phase proteins
49. Describe the immunoglobulins
50. Describe the colloidal osmotic pressure
51. Explain what a GFR is
52. Explain what a chronic renal insufficiency or failure is
53. Explain what azotemia and uremia are and what causes them
54. Name the 3 types of azotemia
55. Discuss creatinine concentration in serum or plasma
56. Discuss urea concentrations versus creatinine concentration in serum or plasma
57. Explain physical examination of urine and UA results
58. Discuss the major pathogenic mechanisms of polyuria
59. Name the major causes for polyuria and polydipsia and their classification

Week 5

LOBs covered during lectures:

60. Describe the basic concepts for the interpretation of electrolyte concentrations

61. Discuss sodium concentrations, hyper and hyponatremia
62. Discuss potassium concentration, hyper and hypokalemia
63. Discuss the sodium to potassium ratio
64. Discuss the chloride concentrations, hyper and hypochloremia
65. Discuss the bicarbonate concentrations and total carbon dioxide concentration
66. Describe increased and decreased bicarbonate concentrations
67. Describe anion gap and explain which diseases and conditions increase it
68. Discuss lactate concentrations
69. Discuss B-hydroxybutyrate and acetoacetate concentrations

Week 6

LOBs covered during lectures:

70. Give a short description of the acid-base balance and the Henderson-Hasselbach equation
71. Discuss metabolic acidosis and the causes of it
72. Discuss respiratory acidosis and the causes of it
73. Discuss metabolic (non-respiratory) alkalosis and the causes of it
74. Discuss respiratory alkalosis and the causes of it
75. Describe the classification of acid-base disorder and the expected compensatory changes
76. Describe hypoxemia and hypoxia
77. Describe the mechanisms of calcium, phosphorus, magnesium, and regulatory hormones in the animal body
78. Describe diseases and conditions that cause hypercalcemia
79. Describe diseases and conditions that cause hypocalcemia
80. Describe the free calcium concentrations and definition
81. Describe the inorganic phosphorus concentration and definition
82. Describe diseases and conditions that cause hyperphosphatemia
83. Describe diseases and conditions that cause hypophosphatemia
84. Discuss the total magnesium concentration and definition
85. Describe diseases and conditions that cause hypermagnesemia
86. Describe diseases and conditions that cause hypomagnesemia
87. Describe the parathyroid hormone (PTH) concentration and definition

88. Describe diseases and conditions that cause increased PTH concentration
89. Describe diseases and conditions that cause decreased PTH concentration
90. Discuss vitamin D formation and concentration and its actions in dog cat and cattle (the role is minor in horses)
91. Discuss calcitonin concentration and function

Week 7

LOBs covered during lectures:

92. Explain what an enzyme is
93. Describe the sources and routes of removal of common serum enzymes
94. Describe the Alanine transaminase (ALT) physiological processes, concepts, and facts
95. Name disorders or conditions that cause increased ALT activity
96. Describe the Aspartate transaminase (AST)
97. Name disorders or conditions that cause increased ASL activity.
98. Describe the Lactate dehydrogenase (LD) and causes for its increased activity
99. Describe the Alkaline phosphatase (ALP) physiological processes, concepts and facts
100. Name disorders or conditions that cause increased ALP activity, describe species and breed differences

Week 8

LOBs covered during lectures:

101. Describe the Gama glutamyltransferase (GGT) physiological processes, concepts and facts
102. Name disorders or conditions that cause increased GGT activity, describe species and breed differences
103. Describe the Creatine kinase (CK) physiological processes, concepts and facts
104. Name disorders or conditions that cause increased CK activity
105. Describe the Amylase (AMS) physiological processes, concepts and facts
106. Name disorders or conditions that cause increased AMS activity
107. Describe the Lipase (LPS) physiological processes, concepts and facts

Week 9

LOBs covered during lectures:

108. Describe the functions of the liver
109. Discuss the physiologic processes that involve bilirubin and bilirubin concentrations

110. Discuss diseases and conditions that cause hyperbilirubinemia
111. Explain what icterus is
112. Discuss bile acid concentration
113. Discuss diseases and conditions that cause an increased bile acid
114. Discuss ammonium concentrations in plasma and causes for hyperammonemia
115. Discuss glucose concentrations in blood and the physiologic processes involved
116. Discuss hyperglycemia
117. Discuss hypoglycemia
118. Discuss glucose during Insulin therapy
119. Discuss hyperinsulinemia and hypoinsulinemia
120. Discuss glucagon concentration and the physiologic processes involved
121. Discuss lipoproteins, classification, metabolism and properties
122. Discuss thyroxin concentrations, properties and physiological processes involved

Week 10

LOBs covered during lectures:

123. Discuss cortisol concentration
124. Name diseases that cause hypercortisolaemia
125. Name diseases that cause hypocortisolaemia
126. Discuss cortisol to creatinine ratio
127. Discuss ACTH concentrations
128. Name suppression and stimulation tests
129. Discuss the definition of shock
130. Discuss hypovolemic shock and its causes
131. Discuss obstructive shock and its causes
132. Discuss cardiogenic shock and its causes
133. Discuss anaphylactic shock and its causes
134. Describe the compensation mechanisms for shock

Week 11

LOBs covered during lectures:

Discuss the following laboratory parameters:
Hematology

135. Complete blood count (CBC)
136. Automated hematology analyzers
137. Packed cell volume (PCV)
138. Red blood count (RBC)
139. Hemoglobin concentration
140. Red blood cell distribution width
141. White blood cell count (WBC)
142. Preparation of blood smears
143. Blood smear evaluation
144. Coagulation testing

145. Serological tests

Chemistry

146. Chemistry analyzers

147. Types of panels

148. Blood chemistry profile

Hormones/endocrine testing

149. Thyroxine

150. Parathyroid hormone

151. Cortisol (baseline or post ACTH stim test)

152. Insulin

153. ACTH

154. Vitamin D

155. Testosterone

156. Progesterone

157. Oestradiol

158. Modified water deprivation test (in investigation of PUPD)

159. ACTH stimulation test

160. Low dose dexamethasone suppression test (LDDST)

161. Blood glucose curve

162. Coombs test

[Week 12](#)

LOBs covered during lectures:

Discuss the following laboratory parameters:

Urinalysis

163. Collection of urine

164. Alterations in color and turbidity

165. Alterations in specific gravity

166. Abnormalities in urine chemistry

167. Abnormalities in urine sediment

168. Infectious agents

169. Culture and sensitivity

Fecal analysis

170. Collection of faeces

171. Faecal blood

172. Faecal parasites

173. Faecal culture

174. Faecal fungal infections

175. Undigested food residues

Cytology

176. Sample acquisition and preparation

177. Solid tissue masses and enlarged organs

178. Thoracic and abdominal effusions

179. General principles of inflammation

180. Cancer biology

181. Cytology of skin and subcutaneous tissue

	182. Cytology of lymphoid tissue 183. Otic cytology		
Prerequisites	None	Required	None
Course Content	<p>Lecture Topics:</p> <ul style="list-style-type: none"> ● Leukocytes ● Erythrocytes ● Platelets ● Hemostasis ● Bone marrow and lymph node ● Proteins ● Urinary system ● Blood gases ● Calcium, Phosphorus, magnesium and their regulatory hormones ● Enzymes ● Liver function ● Glucose and regulatory hormones ● Thyroid function ● Adrenocortical function ● Shock ● Urinalysis ● Fecal examination ● Hematology ● Blood chemistry profile ● Examination of blood smears ● Cytology ● Examination of cytological slides 		
Teaching Methodology	Lecture based learning and laboratory practical sessions		
Bibliography	1. <u>Fundamentals of Veterinary Clinical Pathology, 2nd, Stockham</u> 2. <u>Veterinary pathophysiology, Dunlop</u>		

	<ol style="list-style-type: none">3. <u>Veterinary Clinical Pathology</u>4. <u>Introduction to Veterinary Pathology, 3rd Edition, Cheville</u>5. <u>Small Animal Clinical Diagnosis by Laboratory Methods, 5th, Willard</u>6. <u>Small animal cytologic diagnosis, Barger</u>
Assessment	Final written exam 100%
Language	English